

In the Claims:

WHAT IS CLAIMED IS:

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40. (original) In a touch-screen display system for generating pixel coordinate estimates responsive to a user touching a display screen, an apparatus for enabling detection of a "no touch" state of said touch-screen display system comprising:

at least one bus bar;

at least one driver electrically connected to said at least one bus bar to selectively switch said at least one bus bar between at least two of a plurality of electrical potentials; and

at least one shunt electrically connected across said at least one driver.

41. (original) The apparatus of claim 40 wherein said plurality of electrical potentials comprises a plurality of voltage levels with respect to an electrical ground representative of said pixel coordinate estimates.

42. (original) The apparatus of claim 41 wherein said at least one driver comprises a transistor.

43. (original) The apparatus of claim 42 wherein said transistor comprises an emitter terminal and a collector terminal.

44. (original) The apparatus of claim 43 wherein said at least one shunt is electrically connected across said collector terminal and said emitter terminal of said transistor.

45. (original) The apparatus of claim 43 wherein said collector terminal is electrically connected to said at least one bus bar and said emitter terminal is electrically connected to said electrical ground.

46. (original) The apparatus of claim 40 wherein said at least one shunt comprises a resistor.

47. (original) The apparatus of claim 41 wherein said at least one shunt provides an impedance path from said at least one bus bar to said electrical ground.

48. (original) The apparatus of claim 40 wherein said at least one shunt determines, at least in part, a settling time (discharge rate) corresponding to at least one analog interface of said touch-screen display system.

49. (original) The apparatus of claim 41 wherein said at least one bus bar is electrically connected to said electrical ground through said at least one driver when said at least one driver is powered on.

50. (original) The apparatus of claim 41 wherein said at least one bus bar is at one of said plurality of voltage levels when said at least one driver is powered off and said display screen is being touched by a user.

51. (original) The apparatus of claim 41 wherein said at least one bus bar is electrically connected to said electrical ground through said shunt when said at least one driver is powered off and said display screen is not being touched by a user.

52. (original) The apparatus of claim 41 further comprising at least one analog-to-digital converter electrically connected to said at least one bus bar to convert said plurality of voltage levels to a plurality of digital values representing said plurality of voltage levels.

53. (original) The apparatus of claim 52 further comprising a processor responsive to said plurality of digital values for subsequent detection of said "no touch" state.

54. (original) The apparatus of claim 48 wherein a threshold value is determined, at least in part, by said settling time (discharge rate) and said sampling rate, and is used in determining the validity of said pixel coordinate estimates.

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91. (original) In a touch-screen display system for generating pixel coordinate estimates responsive to a user touching a display screen, a method for enabling detection of a "no touch" state of said touch-screen display system comprising:

selectively switching at least one reference point of at least one axis of said touch-screen display system between at least two of a plurality of electrical potentials by employing electrical driving techniques and electrical shunting techniques.

92. (original) The method of claim 91 wherein said plurality of electrical potentials comprises a plurality of voltage levels with respect to an electrical ground representative of said pixel coordinate estimates.

93. (original) The method of claim 91 wherein at least two of said plurality of electrical potentials comprise a voltage reference level and an electrical ground.

94. (original) The method of claim 92 further comprising providing an impedance path from said at least one reference point of said at least one axis to said electrical ground using said electrical shunting techniques.

95. (original) The method of claim 91 further comprising establishing a settling time (discharge rate) of said at least one reference point using said electrical shunting techniques.

96. (original) The method of claim 92 further comprising electrically connecting said at least one reference point of said at least one axis to said electrical ground when said at least one axis is powered on, using said electrical driving techniques.

97. (original) The method of claim 92 wherein said at least one reference point of said at least one axis is at one of said plurality of voltage levels when said at least one axis is powered off and said user is touching said touch-screen display system.

98. (original) The method of claim 94 further comprising electrically connecting said at least one reference point of said at least one axis to said electrical ground through said impedance path when said at least one axis is powered off and said user is not touching said touch-screen display system, using said electrical driving techniques.

99. (original) The method of claim 92 further comprising converting said plurality of voltage levels to a plurality of digital signals representing said plurality of voltage levels.

100. (original) The method of claim 99 further comprising processing said plurality of digital signals for subsequent detection of said "no touch" state.

101. (original) The method of claim 95 further comprising pre-determining a threshold value from, at least in part, said settling time (discharge rate) of said at least one reference point and said sampling rate, and using said threshold value in determining the validity of said pixel coordinate estimates.

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113. (original) A method of determining whether or not a touch screen has been touched comprising the steps of:

providing an analog to digital converter which supplies an analog to digital reading;
reading a minimum bit level;
determining whether the reading is smaller than the minimum bit level; and

determining the absence of a user touch if the modified reading is less than the minimum bit level.

114. (original) The method of claim 113 wherein the reading step includes the use of a pull down resistor.

115. (original) Apparatus determining whether or not a touch screen has been touched comprising:

means for providing an analog to digital reading from an analog to digital converter;

means for reading a minimum bit level;

means for determining whether the reading is smaller than the minimum bit level; and

means for determining the absence of a user touch if the reading is less than a minimum bit level.

116. (original) The apparatus of claim 115 wherein the providing means includes a pull down resistor.

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122. (original) A method of determining whether or not a touch screen has been touched comprising the steps of:

reading a first coordinate of a coordinate pair at a first time;

consecutively reading the same coordinate at a second time;

determining if the absolute value of the difference between the first coordinate and the consecutive coordinate is less than a predetermined value; and

quantifying, responsive to the difference determining step the coordinate position as a function of the first or the consecutive coordinate.

123. (canceled)

124. (canceled)

125. (original) Apparatus determining whether a touch screen has been touched comprising:

means for reading a first coordinate of a coordinate pair at a first time;

means for consecutively reading the same coordinate at a second time;

means for determining if the absolute value of the difference between the first coordinate and the consecutive coordinate is less than a predetermined value; and

means, response to the determining means, for quantifying the coordinate position as a function of the first or the consecutive coordinate.

126. (original) The apparatus of claim 120 wherein the consecutive coordinate is used as the coordinate position.

127. (canceled)

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131. (canceled)

132. (original) In a touch-screen display system for generating pixel coordinate estimates responsive to a user touching a display screen, an apparatus for enabling detection of a "no touch" state of said touch-screen display system comprising:

at least one bus bar;

at least one driver electrically connected to said at least one bus bar to selectively switch said at least one bus bar between at least two of a plurality of electrical potentials wherein the at least one driver is selected to have an off state impedance establishing a pre-determined discharge rate.

133. (original) In a touch-screen display system for generating pixel coordinate estimates responsive to a user touching a display screen, an apparatus for enabling detection of a "no touch" state of said touch-screen display system comprising:

at least one bus bar;

at least one driver electrically connected to said at least one bus bar to selectively switch said at least one bus bar between at least two of a plurality of electrical potentials wherein the at least one driver is controlled to establish pre-determined discharge rates.

134. (original) A method of determining whether or not a touch screen has been touched comprising the steps of:

- providing an analog to digital converter which supplies an analog to digital reading;
- reading a maximum bit level;
- determining whether the reading is smaller than the maximum bit level; and
- determining the absence of a user touch if the modified reading is less than the maximum bit level.

135. (original) The method of claim 113 wherein the reading step includes the use of a pull up resistor.

136. (original) Apparatus determining whether or not a touch screen has been touched comprising:

- means for providing an analog to digital reading from an analog to digital converter;
- means for reading a maximum bit level;
- means for determining whether the reading is smaller than the maximum bit level; and
- means for determining the absence of a user touch if the reading is less than a maximum bit level.

137. (original) The apparatus of claim 115 wherein the providing means includes a pull up resistor.